Packet Processing in an Optical Router

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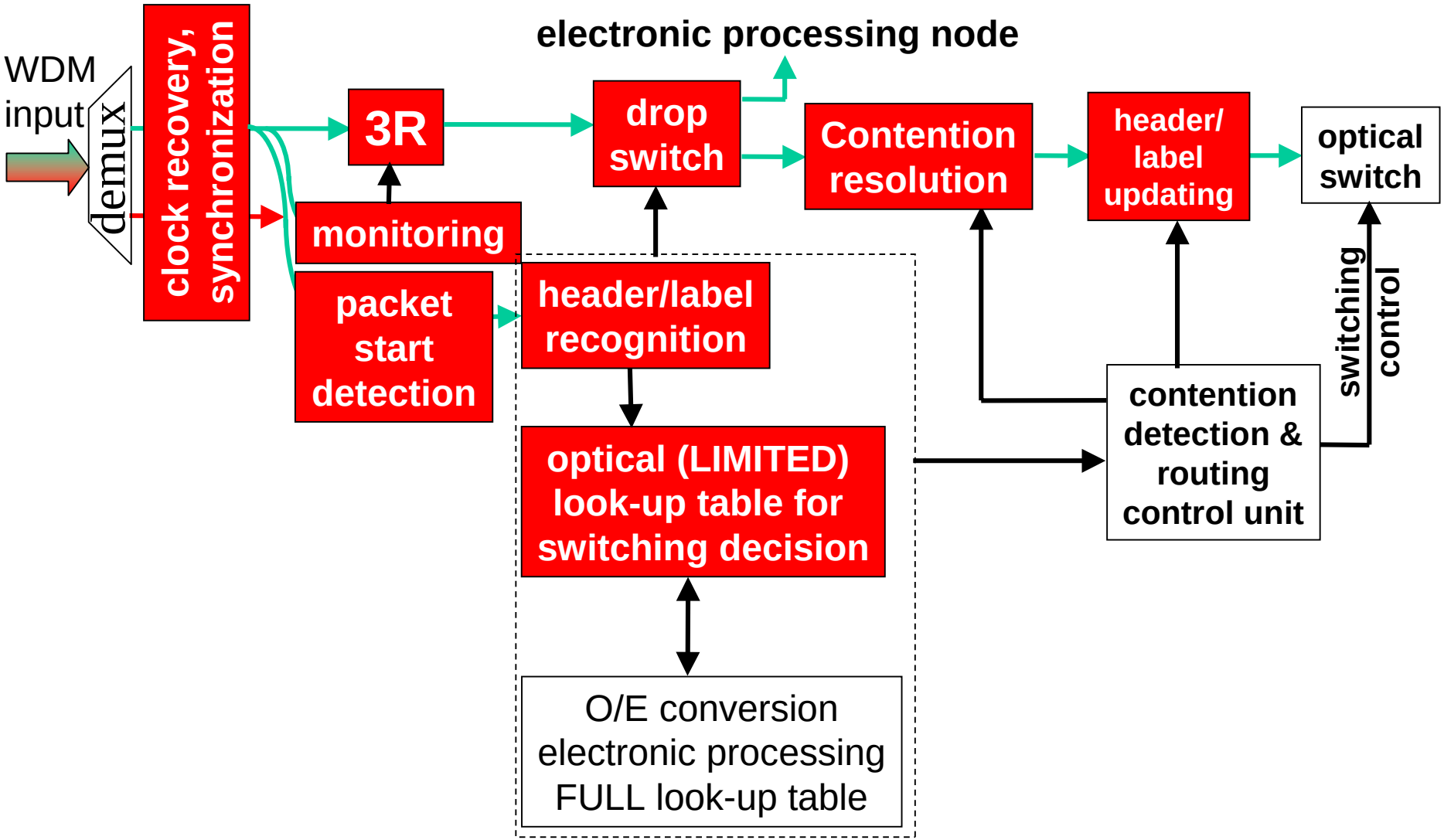
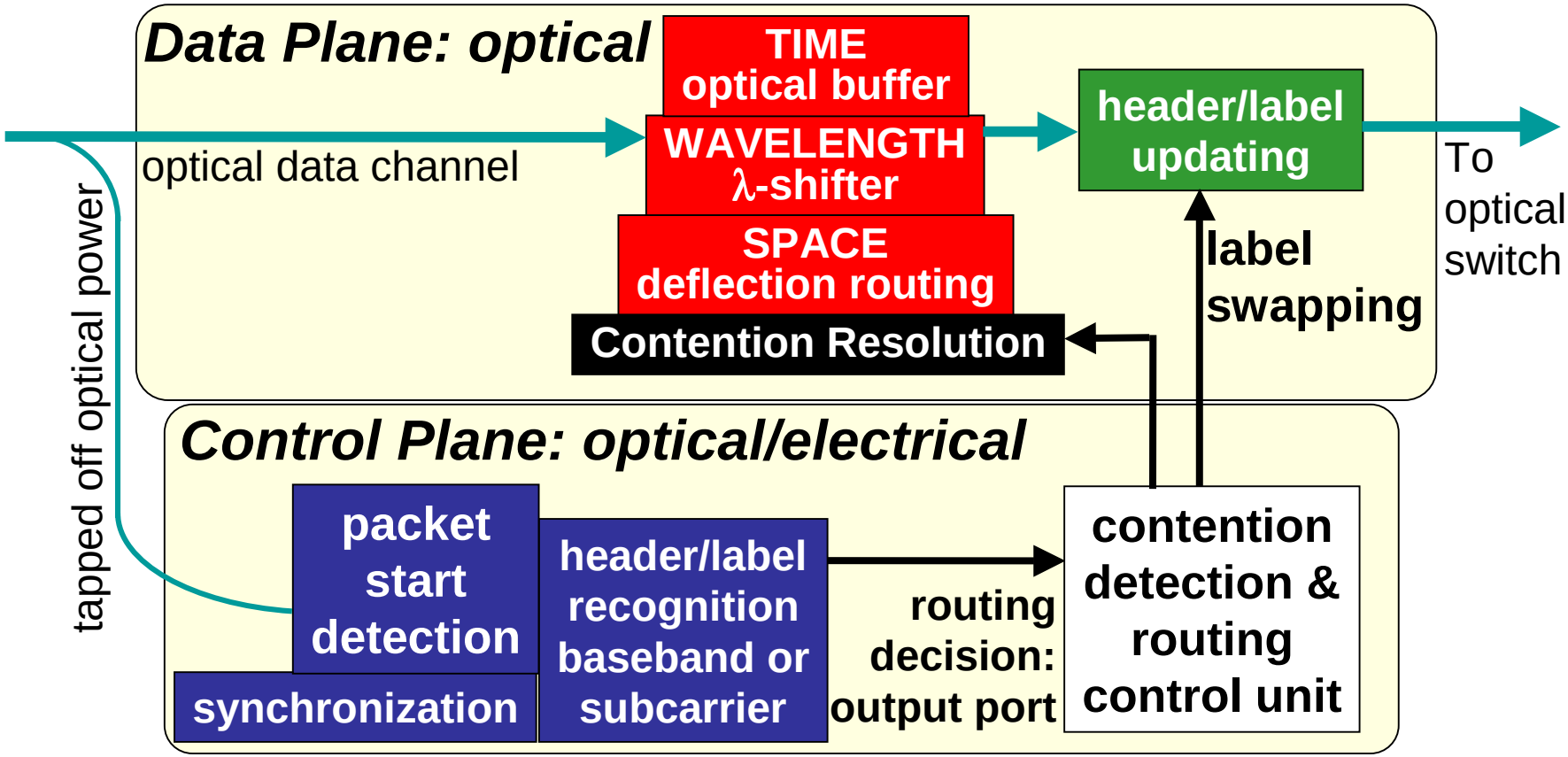
Front-End of an Optical Packet Routing Switch



Building blocks → WDM operation for cost reduction

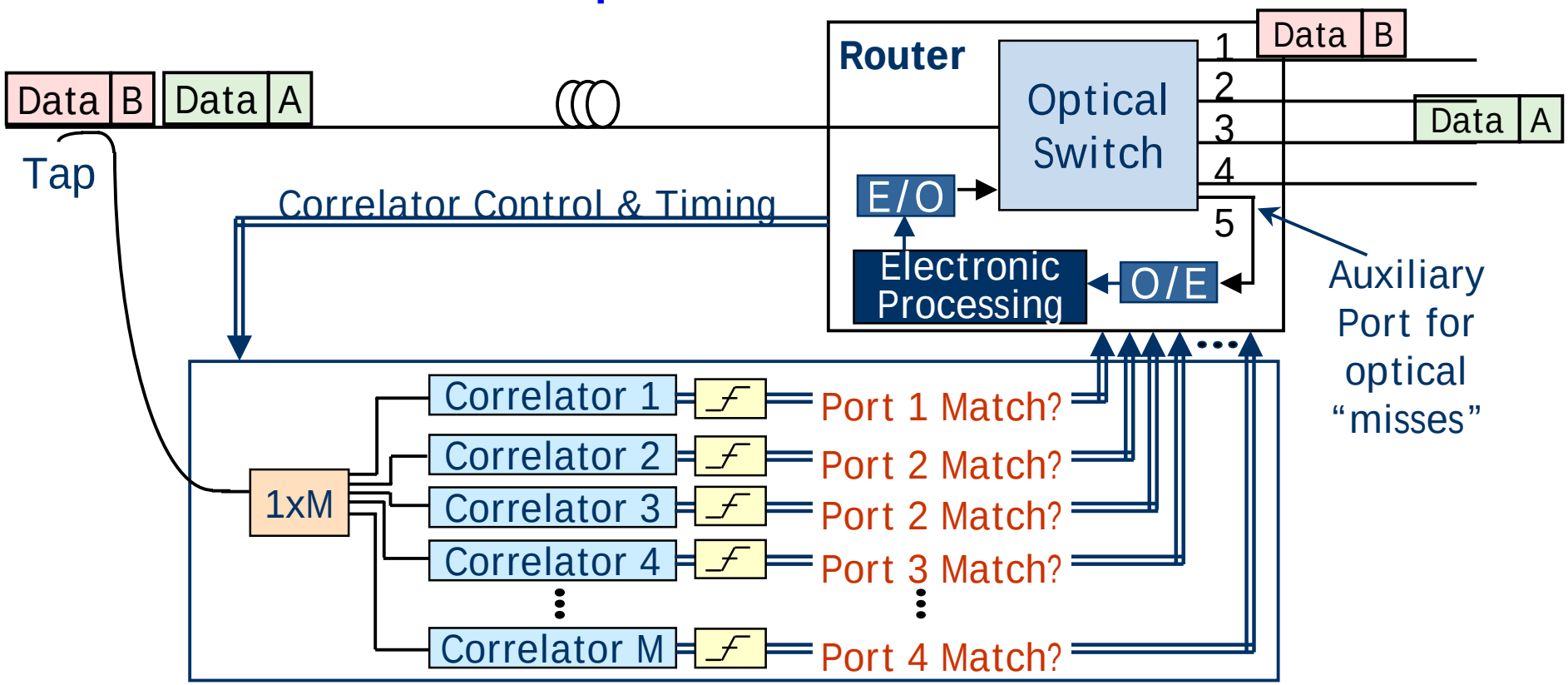
Contention Resolution



- Packet loss rate drops substantially by utilizing the 3 domains
- Example – in a 2x2 switch with an 80% load, it takes **14 wavelengths** to ensure a **10^{-10} packet loss ratio**. If the switch has a **3 packet capacity buffer** only **4 wavelengths** are required

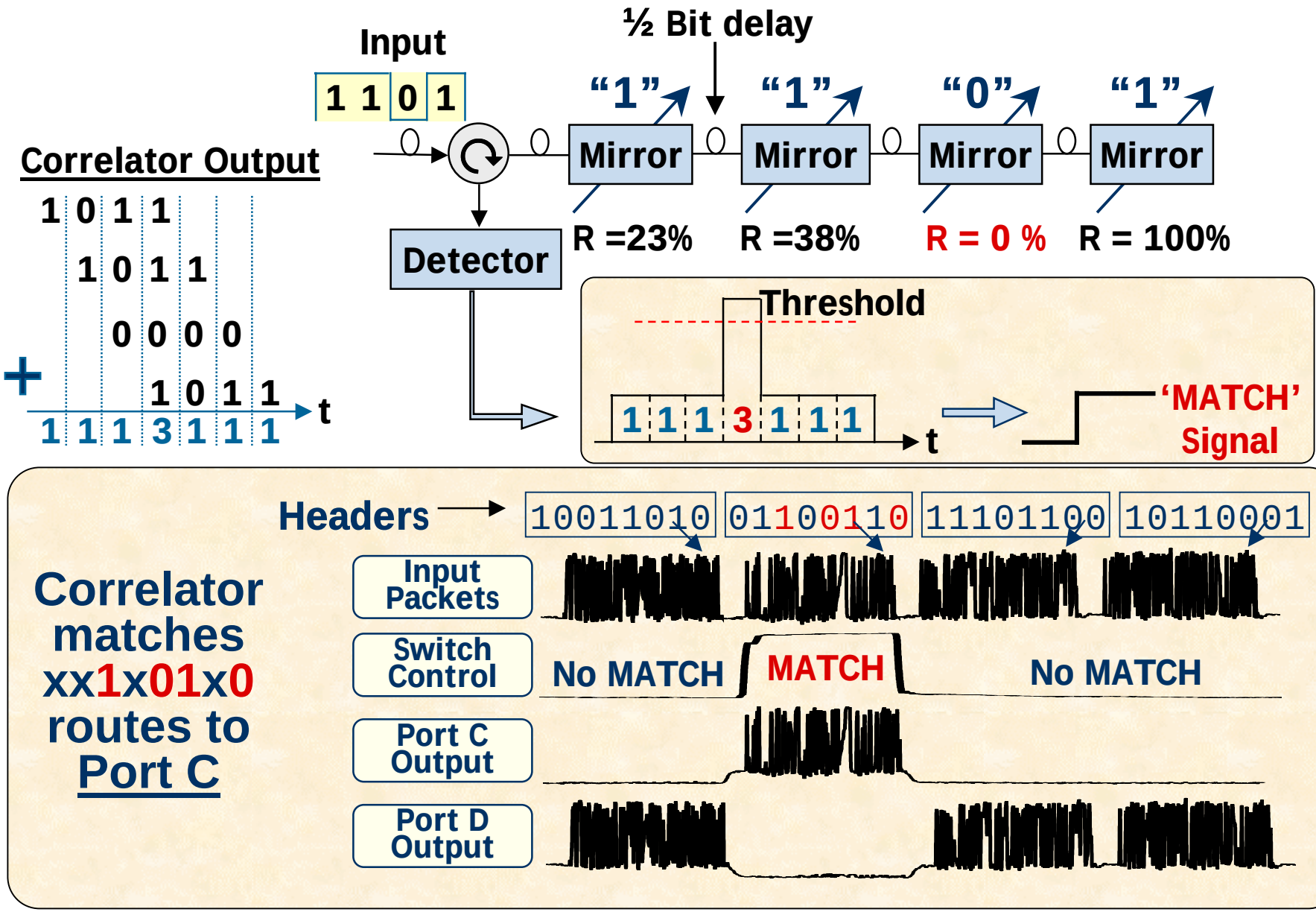
Optically-Assisted Routing : Baseband Example

- **Bottlenecks at electronic routers**
  - Routing tables are **LARGE: >100,000 entries** *and* **growing**
  - Look-up times can be **SLOW (μs or ms)**
- **Bank of optical correlators to provide a cache of "most popular" entries to decrease lookup times to nanoseconds and avoid O/E/O.**



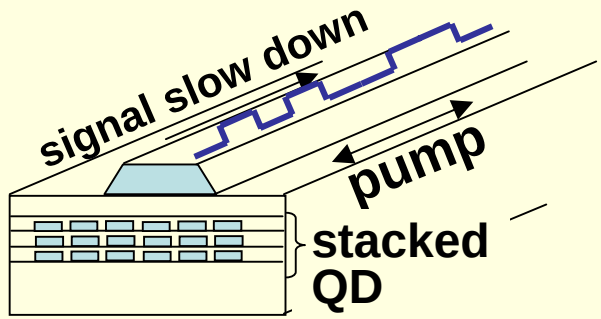
- ***Optical correlators check for a subset of the address bits***
- ***# of correlators are determined by # of address-patterns to be recognized***

Implementation of Optical Correlators



M. C. Hauer, JLT, 2003

Optical Buffering using Slow Light in Semiconductor Nanostructures



- Potentially tunable signal storage
- Enables packet switching
- Achievable buffering time of 8.7 ns for a 10 Gb/s system
- Easy integration
- Cost effective

- Cascade many small switches to form a larger switch with greater buffer depth
- In between the switches, cascade slowing light nanostructures to form selective and variable time buffering
- Selectively activate output or the more delay ports of switches for a quasi-random access operation
- Integrate the system on a single substrate for a cost effective realization

Buffering requirements of optical networks:

✓ Random access

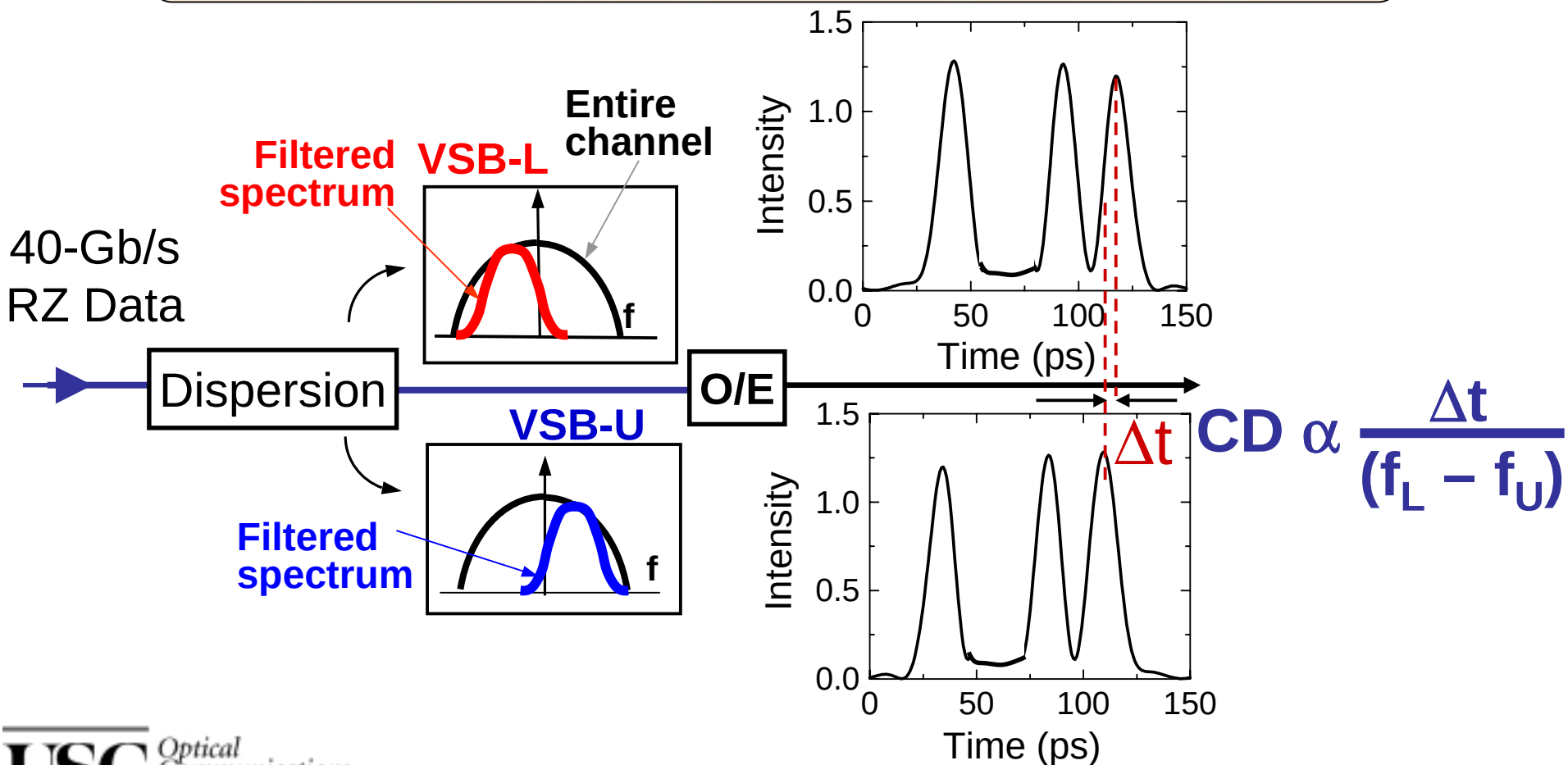
✓ Packet length and bit rate independent

✓ Variable buffer length

C. J. Chang-Hasnain, IEEE Proceedings, 2003

Optical Network Monitoring

- System conditions can change: temperature, path, traffic
- Electronic methods cannot isolate the degrading effects
- Optical network monitoring enables the accurate repair, compensation, and alternate routing in a network



Q. Yu, JLT, Dec. 2002